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Field-angle resolved magnetic excitations in the heavy-fermion metal CeB_6

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Hidden-order phases that occur in a number of correlated f-electron systems are among the most elusive states of electronic matter. Their investigations are hindered by the insensitivity of standard physical probes, such as neutron diffraction, to the order parameter that is usually associated with higher-order multipoles of the f-orbitals. The most well-studied member of this family of compounds is the pure CeB_6 material, which is considered a textbook example of a system with the magnetically hidden order, typically associated with an antiferromagnetic arrangement of magnetic quadrupole moments. As a simple-cubic system with only one f-electron per cerium ion, CeB_6 is of model character to investigate the interplay of orbital phenomena with magnetism. Here we present an experimental and theoretical investigation of multipolar collective excitation modes in the hidden order state of CeB_6. Both low- and high-energy modes are observed with inelastic neutron scattering in fields up to 16.5 T. Their position, field strength and angle dependence is compared to the results of a multipolar interaction model, calculated within a localized approach using the pseudo-spin presentation of the fourfold degenerate Γ_8 crystalline electric field ground state.

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